92-04627/

THE RELATIONSHIP BETWEEN EDUCATIONAL CURRICULA AND THE CAPACITY OF WORKERS TO BENEFIT FROM PERIODS OF RETRAINING

Prepared by

Steven Globerman

Simon Fraser University

Department of Economics

April, 1991

The author thanks members of The Task Force on Employment and Training for helpful comments and suggestions on an earlier draft. He also thanks Robert Sweet for extensive help in identifying and understanding the relevant non-economic literature. He also thanks Ken Strand and Marnie Mitchell for helpful suggestions. All remaining shortcomings are solely the author's responsibility.

INTRODUCTION

The purpose of this report is to address the following questions: What relationship, if any, exists between educational curricula and the capacity of members of the labour force to

(i) learn specific employment skills on-the-job?
(ii) enhance skills through periods of re-training and re-education?

Put more specifically, this report is concerned with the relationship between an individual's pre-labour force entry education (PLFE) and the benefits that individual will receive from additional education and training either in the work place or in educational institutions. Ordinarily these benefits will take the direct form of new or enhanced job market skills. The indirect form of these benefits should be a higher real income over time associated with fewer periods of unemployment and higher paid employment. The underlying premise of this study is that a relationship exists between the PLFE received by an individual and the magnitude of the direct and indirect benefits the individual (and society) can expect to realize from future investments that are made in that individual's on-the-job training and/or other post-labour force entry education.

In effect, we are considering the relationship between PLFE and the capacity of individuals to benefit from future education and training. The underlying hypothesis is that changes should be made to existing PLFE curricula in order to better equip students to learn new skills or augment existing skills after they enter the workforce. The alternative hypothesis is that no plausible changes

in PLFE curricula promise benefits that exceed their associated cost, where the expected benefits take the form of an improved ability to learn new skills or augment existing skills in the post-labour force entry environment.

The relationship between PLFE curricula and the future trainability or educability of workers is arguably important given a widespread view that the productivity of workers will decrease significantly over time without strategic periodic investments in additional training and education. As one federal government report put it: "The state of permanent revolution that information technology introduces to products and processes requires a recurrent remoulding and upgrading of knowledge and skills. This means frequent retraining over the course of a person's working life if he or she is to stay abreast of current basic job requirements." (Employment and Immigration Canada, April 1989, p.5). While some observers argue that skills erode primarily from disuse rather than from changes in the environment (Lerman and Pouncy, 1990), the significant percentage of workers undertaking retraining and recurrent education suggests that such investments are seen as useful to maintaining and augmenting labour market skills.

The report proceeds as follows. The second section offers a brief description of pre labour force education in North America broadly encompassing basic academic and vocational institutions. It also provides a brief statement about what constitutes post-employment training. The third section identifies and discusses issues regarding PLFE curricula including the "mix" of vocational and academic subjects, the content of academic programs and the "quantity" of material taught. The fourth section summarizes approaches to pre-labour force education adopted in some other countries. Section five discusses various aspects of the relationship between PLFE and training. Section six summarizes the study's main conclusions. The final section considers policy

implications and makes proposals for future research.

PRE-LABOUR FORCE EDUCATION IN CANADA

Much of the investment in formal education in Canada takes place in schools, colleges and universities. The basic academic sector comprises primary and secondary schools and post-secondary schools including colleges and universities. The vocational sector encompasses a number of programs provided by technical institutes, community colleges, apprenticeship and industrial training facilities and so forth.

Primary and Secondary Schools

The primary and secondary school sector accounted for approximately 4.7 million students in Canada in 1986 served by some 255 thousand teachers. Approximately 5 percent of all elementary and secondary students are enrolled in independent schools with the remainder enrolled in public schools.(Easton, 1988). In 1986, governments at various levels spent approximately $22 billion on primary and secondary schools. The bulk of this expenditure was financed by the provincial governments. The public school system is available in every province and is funded by government. The Roman Catholic separate school system is publicly funded in Ontario, Alberta and Saskatchewan. Independent or private schools may exist within each province and receive direct funding in British Columbia, Alberta, Manitoba and Quebec.

In 1984, approximately 21 percent of Canadian males and 20 percent of Canadian females had less than Grade 9 education. About 48 percent of males and 52 percent of females had completed high school in Canada. Levels of completed education in Canada have traditionally been below those of the United States, Canada's largest trading partner. For example, approximately 49 percent of Canadian males and 53 percent of Canadian females reported some

secondary education in the 1981 Census. By comparison, 51 percent of U.S. males and 55 percent of U.S. females reported some secondary education in the same year.(Easton, 1988, p.8).

There is no universally accepted formal definition of elementary and secondary school curricula. Indeed, the concept of educational curricula is ill-defined. In a broad sense, curriculum might be defined either in terms of "input" measures or "output" measures. Adopting an input perspective, curriculum might be defined in terms of attributes such as weeks of instruction, content of courses, intensity of instruction, e.g. information conveyed per course, and the distribution of time spent on different courses or subject materials. Adopting an output perspective, curriculum attributes identified might include skills gained by students, personal attitudes developed and knowledge learned. In this context, a wide range of definitions of curricula are potentially meaningful.

A recent statement of policy by the Province of British Columbia suggests that a "learner focused" perspective on curriculum should be adopted. (Province of British Columbia, Ministry of Education, 1990). In our preceding terminology, this suggests an output-oriented approach towards defining curriculum. The Province's suggested focus identifies three specific learning dimensions: (i) the Knowledge learning dimension which involves acquiring a basic understanding of diverse subject matter; (ii) the Skills learning dimension which involves developing the ability to think critically, communicate, reason quantitatively, make decisions and interact with others; (iii) the Attitudes learning dimension which involves developing attitudes related to self-esteem, self-confidence and so forth.

It is beyond the scope of this study to attempt to quantify or qualify elementary and secondary school curricula in terms of these output dimensions. Nor will we do so for other educational institutions, such as colleges and universities. It suffices to

note that all educational programs can potentially be described in terms of these output dimensions, and that it is not at all clear what differences, if any, exist across educational institutions when curricula are defined in these broad terms. Hence, rather than attempt to define extant curricula, (in the third section) we will focus on suggestions for how extant curricula should be changed.

Post-Secondary Schools

The term post-secondary education refers to all forms of formal education that are undertaken following secondary schooling. Post-secondary students are classified by the type of institution they attend, i.e. community college or university. Community college enrollment includes career and university transfer programs, radiography, medical technology, health record and registered nursing programs. Undergraduate enrollment comprises university students in degree, diploma, certificate and non-university courses offered in universities. Graduate enrollment refers to university students in master's and doctoral degree programmes, in graduate diploma and certificate programs, hospital residents, and since 1980, interns.(West, 1988).

Total full-time post-secondary enrollment reached approximately 790,000 in 1985/86. About 323,000 were full time enrollments in community colleges (about 41 percent of the total), with around 467,000 full time university enrollments. The top two fields of study for women attending community college were business/commerce (35%) and health sciences (24%). For men, they were engineering technologies (47%) and business/commerce (23%). (West, ibid., p.15). Of the total full-time post-secondary enrollments in 1985/86, almost 90% were undergraduates. The leading fields of study for women were social sciences (31%) and general arts and science (16%). Social sciences accounted for around 29% of male undergraduates, while engineering accounted for 17%.

The total part-time university population was 285,000 in 1985/86 or about 60% of the total full-time enrollment. Part-time graduate enrollment was about 35,000 in the same period. The distribution of leading fields of study was comparable in the full-time and part-time populations of students.

Of Canada's total population 15 years and over in 1985, almost 21% of males and females had some post-secondary education or a post-secondary certificate or diploma. Almost 12% of males and 8% of females had a university degree. These figures are comparable to those in the U.S. They suggest that a majority of Canadians receive their formal education in elementary and secondary schools which highlights the importance of the educational experience at the earlier ages.

Vocational

Vocational skills encompass the learned ability to perform specific tasks or sets of activities in an industrial context. (Globerman, 1986). Vocational training is carried on by diverse sources. There are government sponsored training programs provided by technical institutes, public trade school (of which there are relatively few) and community colleges. In addition, vocational training is carried out in a variety of non-post-secondary institutions in both the public and private sector. These can range from language courses for public sector employees to word processing courses offered by manpower placement agencies. Courses offered are of varying duration and involve students of varying ages many of whom have already entered the workforce.

Apprenticeship training programs constitute a subset of vocational training. Weiermair (1984) estimates that the number of registered apprentices at the end of fiscal year 1980-81 was 113,408. He found extreme variability with regard to the extent of apprenticeship training, its qualitative (e.g. curricular) nature

and the way in which apprenticeship training schemes are introduced and administered in the various provinces. As of 1980, there were some 153 different Canadian apprenticeship training programs leading to over 153 different skills and/or trades. There is also considerable variation in the split between on and off-the-job training and the ways in which the institutional portion of the training is carried out.

Adult Education

Evidence on the nature of post-labour force entry education is provided by Morrison and Rubenson (1989) based on an analysis of the Statistics Canada Adult Training Survey, a supplement to the Labour Force Survey of January 1989. This survey measured educational activities undertaken by persons who had been part of the labour force for at least one year, who were between 18 and 65 years of age in January 1986 and who undertook education or training programs, courses or instruction for clearly job-related reasons during 1985.

Morrison and Rubenson estimate that (i) 51,258 people took full time training of four weeks duration or longer provided by employers; (ii) 449,440 people took full time training of four weeks duration or longer provided by educational institutions, unions or professional associations; (iii) 1,342,310 people took part-time training including short-term (defined as less than 4 weeks duration) full time training. Full-time training not organized by employers (category ii) is most frequently delivered by colleges or universities. Part-time and short-term full-time training (category iii) is provided most often by employers.

ISSUES REGARDING CURRICULA

There is an extensive and somewhat eclectic literature advocating changes to PLFE curricula. The diffuse nature of the literature and

the eclectic backgrounds of the contributors make it difficult to develop clear and concise summary hypotheses. However, several major themes do seem discernible. One relates to the "quantity" of PLFE that students are required to take. Specifically, there is a school of thought that the benefits associated with increasing the required quantity of PLFE schooling are likely to exceed the associated costs. This leads to calls for increasing the average level of attained schooling in society.

A second and related theme is that students are not being appropriately educated and that the length of the educational experience cannot be held responsible. In effect, the argument is that "quality" rather than quantity is the problem with PLFE curricula. Hence, while the "quantity" argument might suggest putting more of society's resources into PLFE, the "quality" argument suggests that a reallocation of resources could well lead to increased "output" in the PLFE sector.

A third argument focuses on the content of PLFE curricula including the mix of basic academic versus vocational courses. The dominant line of argument in this context is that greater emphasis be placed on basic academic content in all PLFE programs including traditional vocational programs. A related argument maintains that the content of basic academic programs should be modified to deemphasize, at least in relative terms, the traditional "3 Rs". This argument can also be interpreted broadly as suggesting that reallocating resources within PLFE activities will yield benefits that exceed the associated costs.

A fourth argument has more to do with the "delivery mechanism" for PLFE rather than the targeted output of PLFE curricula. Nevertheless, it is related to the argument regarding the mix of academic and vocational courses. Specifically, an increasing number of participants argue that traditional "streaming" into academic and non-academic programs is inappropriate. More specifically, they

argue that the content of courses and training in the two traditional streams be brought more closely together. Some suggest that the distinction be abandoned entirely.

Quantity

Various contributions to the literature suggest that the labour market has changed substantially such that more young people will need additional education and training. This suggestion can be interpreted along two dimensions. One is that most students should be required to increase the length of their PLFE curricula. A second is that only those students falling below some "critical threshold" should be required (or encouraged) to invest in more PLFE than they otherwise would. This distinction is sometimes left vague in the relevant discussion. In other cases, differences of opinion can be identified. For example, some studies argue that the existing "average" PLFE level is about right, but that efforts should be made to ensure that most, if not all students, achieve this appropriate average.[1] Other studies argue that technological change and other developments in the environment are systematically increasing the level of formal education that most students should attain if Canada is to have a prosperous and relatively fully employed workforce.[2]

An example of the latter set of studies is a recent report for the British Columbia government which concludes that as educational requirements for jobs have increased, even the "grade 9" level is questionable for adequate coping in today's society. (Report of The Provincial Literacy Advisory Committee to the Minister of Advanced

---

[1] . See. for example, The William Grant Foundation (1988).

[2] . In effect, this latter view argues not only for an increase in the mean quantity of PLFE but also an increase in the modal quantity.

Education, Training and Technology, 1989). The Report recommends that all adults in British Columbia be enabled to pursue studies to the equivalent of Grade 12 without tuition fees. By comparison, entry into most apprenticeship training programs in Canada require completion of grade 10. In support of this view, several Canadian industrialists identify the educational gap between Canada and Japan as a major source of Canada's competitive disadvantage. One statistic cited is that high school students attend school 243 days in Japan compared to 180 days in Canada. Ninety per cent of Japanese students finish grade 12 compared to seventy-five percent of Canadian students. (Bruk, 1990).

The assertion that more education is required is ultimately predicated upon assertions in the media and elsewhere that technological change is requiring a continual upgrading of skills and that the capability of workers to upgrade skills is related to the quantity of PLFE imparted to workers.(Fowler,1990).[3] This would appear to be the prevailing view in policy discussions of the relationship between technological change and returns to education.[4] However, some scholars argue that new technologies reduce skill levels by simplifying and routinizing work tasks. (Ryan, 1989). This latter view would argue against significant payoffs to increasing the quantity of PLFE activities. Finally, a "middle ground" position is advanced by those who assert that while there is a pattern of underinvestment in all of our nation's youth, there is a particular bias towards supporting students enrolled in institutions of higher education.(The William T. Grant Foundation, 1988).

---

[3] . An example from the media is the claim that "workers must get as much schooling as possible" given increasing global competition. See "Sharpening Minds For a Competitive Edge", Business Week, December 17, 1990, p.72.

[4] . See, for example, Premier's Council Report (1990).

Quality

Several researchers have argued that there is no meaningful impact of the number of courses taken upon assessed proficiency in basic skills such as literacy and numeracy. This argument rests upon evidence from broad sets of secondary school students whereby the number of secondary credits had no meaningful relationship to assessments of skill adequacy in reading or writing (in relation to English credits), or in mathematics (in relation to Mathematics credits). (Hall and Carlton, 1977). For post-secondary students, the same general conclusions apply, only there is more evidence of mathematics courses taken in secondary schools having a stronger bearing upon assessed adequacy. (Ibid.).

There are several possible explanations of the results cited in the preceding paragraph. One is that beyond some minimal level of education, additional courses taken in the basic curriculum have a relatively small impact on an individual's future trainability or educability for workplace tasks. A second is that the courses given in PLFE curricula depart so far from any skill orientation that the number of courses taken provides a poor guide to competencies. A policy implication that might follow from this latter explanation is that educational institutions, especially pre-secondary schools, should focus more attention on reteaching and reinforcing basic skills such as literacy and numeracy. This suggests a reallocation of resources within the educational sector rather than an expansion in the size of the sector implied by increasing the quantity of educational activities. We shall review some relevant evidence bearing upon this suggestion in a later section.

Curriculum Content

Much of the discussion in the literature concerns the subject matter that should comprise PLFE curicula (viewing curricula from an input perspective) or the types of skills that students should

be endowed with (viewing curricula from an output perspective). This is usually a very wide ranging discussion encompassing concerns about the relative emphasis on academic versus vocational courses, as well as the appropriate scope of basic academic PLFE curricula.

(i) Academic versus vocational education

The concept of basic education has somewhat different specific meanings to different observers, as we shall elaborate upon below. In general, basic academic skills encompass the learned ability to read, write and compute. The definition offered by Ulmer and Long (1987, p.112) is representative of a relatively narrow conception of the set of basic skills. They posit that a basic educational curriculum should equip students with the ability to read and write standard English as well as with computation skills. They also suggest that the more complex the culture, the higher the levels of communication required to achieve a basic education.

Levin and Rumberger (1989) offer a slightly broader definition of basic skills. They see basic skills as imparting the ability to use information in an information-rich and computer-mediated environment to address production needs. The components of this skill set include numeracy, literacy and reasoning, as well as technical knowledge, communication skills and problem solving skills.

An emphasis on basic skills in the educational curricula rests upon a view expressed in a report by the MIT Commission on Industrial Productivity. This report asserted that basic schooling from kindergarten through high school is seriously deficient to the extent that it leaves large numbers of graduates without basic skills in reading, writing and mathematics. (Vice, 1990). Similarly, the Ontario Premier's Council report on education and training also stressed that schools must provide a solid basic

foundation for the lifelong development of the skills and knowledge needed to meet the demands of a changing society and changing economy. This foundation would put a premium on basic literacy, as well as an understanding of technology.(Ontario's Premier Council, 1989).

Others object that an emphasis on basic academic education runs a real danger of making schools irrelevant to large portions of non-college bound youth. This leads to calls for a greater emphasis on vocational education in PLFE curricula including incorporating work-based training in educational curricula.(Lerman and Pouncy, 1990). To be sure, the traditional distinction between basic academic and vocational courses is not clear-cut; however, the traditional distinction emphasizes the matching of educational curricula to specific occupational requirements as the distinctive feature of vocational training. The emphasis of vocational education has therefore traditionally been on providing "market-place related" skills (including favourable "attitudes") upon which further training in the workplace can build. The skill-specific nature of vocational education is reflected in the offering of disciplines such as mechanics, electronics, computer operations and so forth.

Critics of a vocational emphasis in educational curricula raise the prospect of educating students for jobs which do not exist by the time they enter the labour force. Our more specific concern is whether vocational curricula ill-prepare students to learn new skills, or augment existing skills, after they enter the work force. The evidence in this regard is inconclusive; however, the general consensus seems to be that basic educational curricula do more to prepare individuals to absorb new skills. (Globerman, 1986).

In fact, most proponents of an increased emphasis on vocational training acknowledge the importance of basic academic skills and,

indeed, suggest that such skills can best be "imparted" in a vocational setting.[5] Hence, the dichotomy between academic and vocational curricula is one of degree. Nevertheless, there is a relevant distinction, on the margin, especially as it extends to the appropriate institutional setting within which to offer PLFE curricula.

(ii) An expanded view of basic academic skills

A somewhat subtle extension of the "conventional" view of basic skills identifies a number of additional competencies that workers will allegedly need to function effectively in the emerging work setting. They include initiative, cooperation, obtaining and using information and multicultural skills.[6] Others reject the merits of a "labour market-based" motivation for defining basic skills and propose a broader "social democratic" motivation. For example, advocates of a "humanistic" content in educational curricula posit that basic education must prepare students for a wide set of roles in society and not simply prepare them for employment. Such roles include parenting and democratic citizenship. Fulfilling these broader objectives suggests the offering of a relatively wide range of courses including economics, politics, sociology, human relations and so forth in PLFE activities, including those at the elementary and secondary school levels.(Dippo, 1988).

In evaluating arguments for a broad view of basic skills, it must be acknowledged that improved labour force performance is only one objective of the proponents; however, since the focus of this report is ultimately concerned with labour-market mediated impacts

---

[5] . See. for example, Grant (1987) and Levitan and Gallo (1988).

[6] . This view is consistent with the philosophy of curricula revisions suggested in Province of British Columbia (1990) which emphasizes a broad range of basic skills and attitudes.

of PLFE curricula, we do not entertain this implied broader measure of social welfare that underpins calls for more humanistic curricula.[7]

An important environmental development underlying arguments for an expanded definition of basic academic skills is a shift from traditional organizations with a detailed division of labour to one that has less hierarchy and more worker participation in decision-making in order to increase productivity (Levin and Rumberger, 1989). This type of shift allegedly both increases the overall skill and educational requirements of workers, as well as puts a greater emphasis on interpersonal skills and "emotional" as well as intellectual growth. In contra-position, concerns have been expressed that broadening the traditional basic academic curricula will lead to a compartmentalization of skill specialties in a fragmented curriculum which is ineffective in transmitting basic literacy and numeracy skills.(Hall and Carlton, 1977).

The importance of pedagogy and "classroom" procedure are clearly recognized in the education literature, particularly in conditioning the impacts of specific curricula.[8] For example, if cooperating with fellow employees is identified as being an important workplace skill, training exercises which emphasize group-oriented learning experiences will presumably better promote attainment of this skill, as compared to individually oriented learning experiences. In similar fashion, if individual initiative and autonomy are also seen as important skills for the contemporary economy, appropriate adjustments to classroom pedagogy can presumably support the production of these skills.

Notwithstanding the relevance and importance of pedagogical

---

[7] . This should not be interpreted as a rejection of the merits of the humanistic philosophy.

[8] . See, for example, Tyler (1949).

issues to an overall review of PLFE activities, we shall not address any in this report. This is both because we have little expertise on the subject and because the focus of the report is the broad nature of PLFE curricula and not the specific techniques that are optimally associated with the chosen curriculum.

Delivery Mechanism

As noted above, many proponents of increased vocational training acknowledge the importance of producing basic academic skills as part of the output of vocational training. Implicit if not explicit in the promotion of increased vocational training is a view that basic academic skills are best developed in a vocational context, at least for large numbers of students. This view, which calls for a "polytechnic" approach to PLFE, contrasts with traditional "streaming" approaches whereby academic and vocational PLFE activities tend to be segmented. Others remain sceptical about implementing educational and training programs that assume a single, simple or unitary effect of technological change on required skills and appropriate PLFE curricula.[9] These observers tend to favour a variety of approaches to delivering educational curricula following a "risk diversification" principle.

APPROACHES TAKEN IN OTHER COUNTRIES

In attempting to evaluate the foregoing hypotheses, one tack that has some intuitive appeal is to identify approaches toward PLFE activities taken in other countries. A reasonable premise is that if there is relative consistency across different countries, the ubiquitous pattern observed may reflect a socially efficient outcome. To be sure, an objection to this inference is that educational authorities in different countries will tend to mimic each other, assuming that the "norm" is optimal even though it may

---

[9] . See, for example, Spenner (1988).

not be. Furthermore, given differences in levels of economic development, opportunity costs of students, training opportunities in industry and a host of other factors, it is unlikely that any one approach to PLFE would be "optimal" across all countries. Nevertheless, some useful insights might be gained from comparing and contrasting domestic practice with those of other countries.

It must be acknowledged at the outset that no comprehensive evaluation of PLFE curricula in other countries was undertaken, since such an evaluation would have been well beyond the time and resources available for this study. As such, our review was intended to identify major patterns and distinctions that bear upon the issues identified in the preceding section.

Perhaps the most significant characteristics identified in our review are the greater emphasis on vocational training, including apprenticeship training, outside of North America and the much weaker streaming between academic and vocational PLFE activities. For example, Scottish authorities recently decided to break down boundaries between schools and other academic institutions and vocational training centres. Students can study at several institutions simultaneously or can be accredited through training organizations instead of colleges or schools. The Technical and Vocational Education Initiative (TVEI) allows students (14-18 years old) to choose options to meet their interests and prospective needs, e.g. business studies, computing, pneumatics, control technology and so forth, while enhancing training in English and mathematics and other "core" courses. (Bell and Howieson, 1988). While observers argue that it is too early to assess the effects of TVEI, the response of the students has been favourable.

Along similar lines, some observers point to successful apprenticeship programs in Sweden and Germany as indirect evidence of the benefits of merging vocational and academic educational

curricula.[10] For example, Sweden begins orienting children to "worklife" in the first grade through visits to offices and factories. In the Swedish Gymnasiaskola, pupils choose from 13 vocational areas, which entitle them to enroll for up to 12 hours per week in a more theoretically oriented course. The school provides students with a basic broad education together with marketable vocational skills within the same campus. The Swedish system makes provision for those who complete a two-year vocational course to be eligible to proceed to higher education in the same way as those who complete a traditional three year theoretical course, if they so desire.(Grant, 1987).

In Denmark, a similar scheme has been set up with the aim of offering theoretical learning linked to practical applications. Pupils are divided into a number of job groups, such as mechanics, builders, journalists, artists and so forth, with a teacher attached to each group. Pupils learn these trades and professions while following the state curriculum towards formal education. Danish authorities believe that if pupils can identify a directly relevant area of the curriculum, they are more motivated to achieve in other ways, such as numeracy and literacy. (Grant, ibid.)

In summary, there is some evidence from the experiences of other countries that an emphasis on streaming into academic and non-academic programs may be counter-productive, at least to a point. Specifically, academic skills can apparently be successfully imparted within a work-oriented context.[11] Along the same lines, Levitan and Gallo (1988) in their review of the U.S. experience with its Job Corps training program identify successful

---

[10] . See, for example, Weiermair, (1984).

[11] . It is relevant to note that Japanese PLFE curricula tend to be academic in their orientation; however, Japanese companies are also reported to operate very successful employee training programs.

collaboration between educational and vocational instructors to resolve occupational training problems attributable to poor reading skills. Teachers also work informally with vocational instructors when corpsmembers faced training difficulties attributable to deficient math skills.

The experience cited by Levitan and Gallo also suggests that academic and vocational curricula can be complements rather than substitutes in supplying students with the basic academic skills they need to absorb future training and adult education. That is, many students may absorb so-called academic training when it is offered in a vocational environment; i.e. when the academic training is clearly related to work-place oriented tasks. Indeed, in 1980 the Job Corps began a major overhaul of its vocational program to establish standardized courses which stress the basic skills necessary to perform in each occupation. (Levitan and Gallo, ibid.). Along similar lines, it is reported that a number of high schools in the U.S. are developing programs of applied learning, which integrate academic and vocational subject matter, and thus help students learn in context through hands-on techniques. (Lerman and Pouncy, 1990).

PLFE AND TRAINING

In this section, we consider evidence from the "marketplace" on the relationships of interest. Before so doing, it is useful to consider the type of evidence that might be relevant in this regard.

The traditional approach taken by economists is to estimate rates-of-return to different amounts and types of PLFE. The return to education in the labour market will be a function of several factors:

(i) the direct increase in the workplace productivity of the investor over the investor's working life assuming no additional education;

(ii) the increase in the probability that the investor will undertake future investments in formal education or on-the-job training;

(iii) the enhanced capacity of the investor to increase his or her workplace productivity through future investments in adult education, on-the-job training and so forth.

The direct concern of this study is conceptually with items (ii) and (iii) above. Item (ii) essentially links the likelihood of individuals taking additional education to the PLFE curricula they experience. Item (iii) links the ultimate effectiveness of further education to the PLFE curricula. Debates about appropriately designed curricula implicitly assume that significant links exist of the type described in earlier sections.

The aforementioned link between the increase in the probability that a student will undertake future investments in formal education or on-the-job training is, in principle, straightforward to measure. In a sample of individuals with different PLFE backgrounds, one would identify participation rates in future education (or on-the-job training) with PLFE backgrounds holding other factors constant; however, the expected direction of the relationship is not clear. For example, one can hypothesize that "effective" PLFE curricula will provide individuals with the skills needed to benefit from additional education. Hence, they will be more likely to invest in additional education or on-the-job training after entering the workforce. On the other hand, effective PLFE curricula may equip students with skills that are less subject to "depreciation" by developments in the economy such as technological change. Hence, the demand for post-labour force

education on the part of these students might actually decline. In short, the empirical relationship between PLFE curricula and future investments in education may reflect mixed effects.

The link between PLFE curricula and the impact of future education on an individual's productivity is more difficult to measure. Conceptually, one might measure the link by individuals' performances in education and on-the-job training programs. That is, in a sample of individuals who begin a specific on-the-job training program or adult education program, one might relate the individuals' likelihood of successfully completing the training to the PLFE curriculum undertaken by the individual. The theoretical relationship here is straightforward: individuals who have undertaken appropriate PLFE curricula should be more likely to complete successfully any additional training or education that they undertake.

One might also measure the effectiveness of additional education by the labour market performance of individuals who undertake on-the-job training, adult education and so forth. One would expect students who had undertaken appropriate PLFE curricula to enjoy greater labour market returns from additional education. To be sure, an appropriate PLFE curriculum for on-the- job training might be different than that for specific adult education and retraining programs. For example, PLFE curricula more heavily weighted towards vocational courses may be more appropriate for maximizing the benefits of on-the-job training, whereas more academic curricula may be more appropriate for adult education and retraining programs.

The foregoing relationships are clearly amenable to focused research, and in a later section we describe several potential research projects that address aspects of these crucial relationships.

PLFE and Future Education

In this section, we consider evidence bearing upon the relationship between the PLFE education experiences of individuals and their willingness to invest in further education. In fact, there is relatively limited evidence on this linkage. In one study, Cervero and Kirkpatrick (1990) divide adult education into two broad categories: (i) education conducted by formal educational institutions for which credit is granted and (ii) other types of education that are not credit bearing. The data source for the study is the (U.S.) National Longitudinal Survey of the High School Class of 1972.

The principal findings of this study may be summarized as follows. When one controls for other relevant pre-adult characteristics of the individuals comprising the sample, e.g. the socio-economic status of parents, educational attainment is not useful in explaining an individual's participation in non- credit forms of adult education. The type of high school program undertaken by an individual is significantly related to the individual's participation in non-credit adult education. Specifically, individuals who had undertaken academic types of curricula were more likely to participate in non-credit forms of adult education than those who had undertaken non-academic types of curricula. (Ibid.)

On the other hand, educational attainment is clearly important in predicting participation in credit adult education. Indeed, it is the most important predictive factor, i.e. those with more education were more likely to participate in for-credit adult education programs. As well, the type of high school education program pursued is also a significant influence on participation in credit adult education. Again, individuals who had undertaken academic types of curricula were more likely to participate in for-credit adult education programs.

The Cervero and Kirkpatrick study therefore suggests that academic PLFE curicula are more likely to encourage further investments in adult education than non-academic curricula. The relevant evidence is much weaker for the noncredit variety than for credit adult education.

The more pointed issue, of course, is whether academic PLFE encourages additional education because it increases the returns to post-labour force training and education or because of a spurious correlation; i.e. people who value education largely value it for its own sake and the relationship over time simply reflects specific "tastes" for education. In this regard, the fact that the bulk of individuals enrolling in adult education courses are updating their professional skills in areas such as medicine, nursing, accounting and law suggests that the adult education decision is taken primarily to improve performance in the labour market.[12] This further suggests that the persistence of educational investment over time reflects specific patterns in returns to education that, in turn, are linked to PLFE.

The quantitative importance of PLFE activities and subsequent investments in education should not, however, be overstated. For example, studies which seek to explain the determinants of participation in adult education find that the models, including educational achievment variables, are capable of explaining a relatively small fraction of the phenomenon.[13] Moreover, as noted earlier, survey evidence suggests that in some samples of students, there is no meaningful impact of the number of courses taken upon assessed proficiency in reading and writing.

Morrison and Rubenson (1989) for their Canadian sample also find

---

[12] . For evidence on the types of people who enroll in adult education programs, see Long, 1987.

[13] . See ibid., p.12.

that participation rates in adult training increase rapidly with educational attainment. In the part-time/short-term category, for example, throughout Canada the rate increases from 1.5% for persons with only elementary education to 19.8% for persons with university degrees.

Denton, Pineo and Spencer (1990) present the results of multivariate regression analysis from the Adult Education Survey. They considered separately each of 5 types of adult education courses- academic, job skills, hobby, language training and "other." They find that education has a major influence on participation. For both men and women, rates of participation are extremely low among those with no high school education, and low also among those reporting some or completed high school. In contrast, the three levels of education beyond high school show much higher rates, those for "university completed" being the highest and those for "some post-secondary" and "post-secondary certificate or diploma" being somewhat lower.

It is interesting to note that education has a strong influence on the propensity to take academic courses as well as job-skill courses. Education is a strong influence also on the "hobby" category, although the relationship is much weaker than for the academic and job-skill courses. It is also relevant to note that the explanatory power of the estimated regression models is quite low as was the case in the Cervero and Kirkpatrick study.

PLFE and Trainability

In fact, there is no direct evidence, of which we are aware that relates an individual's PLFE curricula to his or her trainability or educability in a post-labour force entry environment; however, there are studies which discuss the attitudes of employers towards labour force entrants, and specifically their attitudes towards the educational background of entrants.

Based on a survey of Scottish businesses, Raffe (1988) reports that employers recruiting young people tend not to value specific vocational skills very highly. Rather, they tend to want people with ability and social and personal qualities which make them potentially good workers able to learn and develop on the job. Raffe suggests that having taken "high-status" (academic) subjects rather than "useful" subjects is taken by prospective employers as a proxy measure of this potential.

It is certainly possible that the academic criteria used by employers to rank would-be employees in terms of their trainability are inappropriate as some have suggested; however, it can more plausibly be argued that employers have a strong incentive to maximize the returns to their investments in on-the- job training, and that the use of reliable screening criteria to identify successful trainees contributes to optimizing returns. Evidence that individuals enjoying higher levels of academic training are more mobile across occupations is consistent with a view that academic training is a relevant screen for trainability. (West, 1988).

Nevertheless, it is still possible to argue that the impacts of specific curricula differences are small relative to other determinants of the employers' screening process. In this regard, comparisons of the Scottish and English educational systems are instructive. In particular, the curricula boundaries between vocational college courses and largely academic school courses have traditionally been stronger in Scotland than in England. However, the Scottish system offers a wider variety of academic subject courses for post-compulsory students. While the differences between curricula are seen by educationalists to be relevant, the differences in youth employment markets between Scotland and England are seen to be relatively small.

Perhaps of greatest relevance in the latter respect is the fact

that there are strong similarities in the distribution of youth employment by occupations and by industry in comparing Scotland to England, including individuals who had gone through industry training programs after finishing their compulsory education. (Raffe and Courtney, 1988). This latter observation suggests that labour markets may not make sharp distinctions among individuals based upon the mix of academic and non-academic training they embody so long as they possess minimally acceptable literacy and numeracy skills.

There is no shortage of claims on the part of North American managers that an increased emphasis on basic academic skills, as well as an increase in PLFE activities, are appropriate for the "emerging" workplace. The following quote is quite representative of the general position taken:

> Today's technologies - micro-electronics, telecommunications and new materials - will change the skills required by workers in most, if not all, occupations. The organization and management of work will also change. As a result, greater analytical, problem solving and communication skills will be needed by all workers. Competitive pressures, technological change and market demands will also shift the mix of occupations. Those who require lower levels of training and education will represent a declining share of employment. Between now and the year 2000, almost half of the new jobs will require more than 5 years of combined education and training beyond the completion of high school.(Employment and Immigration Canada, 1989, p.1).

A government survey of Ontario employers offers the following observations:

> The concept of fundamental skills can be construed as having 4 dimensions: analytical problem solving skills, functional literacy, technological literacy and interpersonal and communications skills. The challenge for the colleges is to structure these components of fundamental skills into every aspect of their curriculum programming.(Ontario College of Regents, 1989, p.11)

> The teaching of literacy must be incorporated across all aspects of the curriculum.... Technological literacy is predicated on a basic grounding in science, math, literacy and some computer skills.(Ibid., p.15)

A range of industry task force studies undertaken for Employment and Immigration Canada come to much the same conclusions:

> Production workers who once had narrowly defined responsibilities are becoming part of multi-skilled, self-managing production teams. This approach calls for greater analytical, problem-solving, communication and inter-personal skills on the part of workers.(Employment and Immigration Canada, 1989,p.5).

As suggested by the foregoing quotes, underlying many of the arguments for altering or augmenting PLFE curricula is a view that technological change is affecting traditional demand patterns for skills. In fact, technology can affect skill demand in two broad ways:

(i) by altering the composition of jobs in the workforce;
(ii) by altering the skill content of individual occupations.

The literature linking technological change to occupational skill demands is quite broad, and we will only reference several seminal review studies. There have been two approaches to studying this issue. One encompasses aggregate studies which examine average skill changes across a large number of occupations or industries. A second includes case studies which provide a considerably more detailed picture of skill transformations for a particular industry, occupation or firm.

Without gainsaying difficulties and controversies in defining skill levels, empirical studies tend to partition job characteristics based upon two broad constructs: substantive complexity and autonomy-control.(Spenner, 1988). Skill as substantive complexity refers to the level, scope and integration of mental, manipulative and interpersonal tasks in a job. Skill as autonomy control refers to the discretion available in a job to initiate and conclude action, to control the content, manner and speed with which a task is done. Across jobs in the economy, the two dimensions are positively correlated.(Ibid.)

Spenner (1988) interpretes the collectivity of evidence from aggregate studies as showing no dominant trend in the 20th century and suggesting evolutionary not revolutionary rates of change. On balance, he reads the evidence as suggesting approximate net stability of skill requirements or at most a small upgrading. The evidence from case studies suggests offsetting trends. That is, while the substantive complexity of work environments may have

gradually increased across the economy, skill levels as autonomy-control have seemingly gradually decreased.

Spenner's main conclusion arguably is that there is nothing in the literature which suggests a dramatically increased or decreased role for education and training in the economy. One qualification he makes to this statement is that workers of today need basic skills, such as the ability to read, whereas a large fraction of the workforce in earlier years survived relatively easily without such skills. He sees the strongest case for more post-secondary and vocational education coming from those studies that show more educated workers are better able to adapt to technological change. In terms of policy, he suggests that this means more schooling for the lowest one-third or one-half of the schooling distribution, versus the top half of the distribution.

Spenner's interpretation of the literature is quite comparable to Globerman's (1986). Specifically, Globerman fails to find evidence to support a conclusion that technological change is causing a systematic "mismatch" between job skills demanded and job skills supplied. He also concludes that basic educational skills apparently prepare the worker to adapt to new labour market requirements through on-the-job training or other forms of post-labour force entry education. Globerman also tends to emphasize the benefits of increasing relative expenditures on basic education at the lower schooling levels, although he ventures no opinion on whether absolute real expenditure levels on education should change.

Through a fairly extensive set of case studies, Hall and Carlton (1977) come to quite similar conclusions. Specifically, they conclude that new technology generates increasingly unequal demands even for the mathematical skills with which it is so closely associated. While researchers and managers in scientific or technical fields may find themselves under enhanced pressures to

exhibit mathematical skills, other workers may be increasingly absolved of the requirement for computational skills by the products of new technology, e.g. calculators, computerized office machinery and so forth, which render obsolete the need for skill in mental aritmetic. Hall and Carlton further suggest that even literacy skills may be diminished in importance by new technology which substitutes visual imagery for the written word.

Notwithstanding their sceptical view of the skill-intensifying impact of technological change, Hall and Carlton emphasize the importance of imparting competence in basic skills at the earliest stages of PLFE. They argue that success in later educational activities hinges quite strongly upon adequate early training in the basic skills.

It should be noted that the foregoing review of the literature focuses on possible changes in employment-related skills as a function of technology. The prudent conclusion would seem to be that technological change, to date, has imparted no significant changes to the returns to traditional educational curricula, and that it offers no basis of support for calls to significantly change either the "quantity" or nature of PLFE education in Canada. This is not to say that other dimensions of life may not be improved by altering educational curricula; however, we are aware of no reliable evidence on this point.

It should also be noted that studies emphasizing the continuing relevance of basic skills do not necessarily argue against vocational educational curricula. On the contrary, for many individuals, vocational education combined with apprenticeship programs may be effective at imparting basic skills and other desirable work force-related attributes.

Tilak's (1990) comprehensive survey of the vocational training literature suggests the following conclusions:

(i) investment in vocational training per se is economic;

(ii) formal vocational/technical education does not compare favourably with general secondary education;

(iii) compared to firm-based on-the-job training, formal vocational schooling has definite advantages.

Tilak emphasizes that the higher returns to general secondary education are primarily characteristic of developing countries. Estimated returns are relatively comparable in developed countries.

In summary, Tilak's review of the evidence does not support a view that vocational curricula should be subservient to academic curricula as a general proposition. It is tempting to infer from Tilak's evidence that the basic skills acknowledged to underlie successful labour market performance can potentially be supplied in academic and vocational contexts, although this is admittedly a speculative inference from Tilak's discussion. The main point here is that vocational training should not be seen necessarily as a substitute for general secondary education. Rather it should be seen as an alternative vehicle for "delivering" basic skills in a more immediate "work-oriented" context.

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

This review and analysis points to a number of conclusions bearing upon the main issues identified in an earlier section of this report. One issue concerns the appropriate balance between academic and vocational curricula. It seems fair to maintain that basic skills as traditionally defined in the literature continue to underpin the ability of individuals to respond to changes in the workplace environment. This response includes the ability to identify needs for future training and education and the ability to benefit from such training and education. Technological change and other developments in the economy do not appear to seriously qualify this conclusion.

The available evidence also suggests that technological change and other related events have had no systematic impact on the optimal "quantity" of PLFE activities. As such, calls for substantial increases in the length of curricula or (equivalently) the average time spent in PLFE programs are not supported by historical data; however, there is a basis for arguing that increased social investments are justified to raise the average education levels of those individuals who would otherwise leave school well before the average leaving age. Further support for an emphasis on early stages of schooling is provided by the observation that private and social rates-of-return to education drop dramatically when comparing elementary and secondary schooling. In some studies, for example, the social rates of return to secondary education are somewhat less than half those to elementary education.(Easton, 1988).

The available literature suggests that the dichotomy between academic and vocational training may be exaggerated. Specifically, the delivery of the basic skill set can take various forms. For many individuals it may be most effectively delivered in a "vocational" environment. For others, an "academic" environment may be more appropriate. Indeed, diversification in delivery systems may be both more effective given heterogeneous students and risk minimizing, i.e. the effectiveness of different delivery systems may change over time.

There is no firm basis for determining the optimal time for streaming students into vocational and academic activities. For example, the precise age at which "dual branching" takes place varies from country to country. Vocational studies begin at about age 13 in Belgium, Luxembourg, Ireland and the Netherlands. In Luxembourg, students can opt at age 13 to continue with general education (academic) or take vocational or "complementary" education (essentially life skills and pre-vocational studies). In France, pupils receive a general introduction to vocational

subjects at age 11 to 13. Technical subjects can begin in earnest at age 13 to 14, when young people can decide to concentrate to some extent either on technical and vocational subjects or on academic subjects. In Greece, vocational studies can commence at age 15 (Johnson, 1981). In short, many countries have chosen to "blur" institutional distinctions between different educational delivery systems at relatively early stages in the PLFE process while still acknowledging the need to provide all students with a basic core of skills.

The final issue raised is the appropriate scope of basic skills. Economists would identify the appropriate range of basic skills by the following criteria: the social returns to the last dollar spent on developing any one basic skill in a cohort of students should equal the social returns to the last dollar spent on developing any other basic skill. Unfortunately, the available evidence is far too skimpy to permit any firm conclusions as to whether the scope of basic skills constituting academic curricula is excessively broad or excessively narrow. Clearly there are cost penalties associated with diversifying curricula just as there are with diversifying delivery systems. There are also risk diversification benefits to broadening curricula and delivery systems. However, there is at least some evidence giving cause for concern that there is an excessive amount of specialization in PLFE curricula, especially given the view that basic skills training needs reinforcement in secondary school programs.

Specialized curricula offerings, particularly in vocational education programs, may leave many students without an adequate grounding in basic skills. While it is not possible to identify the "optimal" degree of specialization in PLFE curricula, there are grounds for concern that there is a tendency towards excessive specialization, both in terms of cost and in terms of knowledge gain.

Several broad policy implications follow from these conclusions. One is that governments should be cautious when considering substantial increases in educational activities tied to perceived changes in the workplace environment. Alleged increases in the educational content of jobs are largely speculative, and there is substantial ambiguity about whether the "payoff" in the labour market to increased education will increase or decrease in the future.

A second policy implication is that basic (or academic) skills appear to be a prerequisite to a flexible workforce; however, there is no single delivery mechanism that is best suited to impart basic skills to a broad constituency of students. For example, basic skills may be best imparted to large numbers of students in a vocational context. Indeed, rigid curricula distinctions between academic and vocational subjects may be counter-productive for many students. Rather, they might well be complementary approaches to imparting basic skills, especially for non-college bound students.

Finally, the available evidence raises a caution against increasing specialized curricula offerings. Such specialized offerings may adversely impact students' absorption of the core set of literacy and numeracy skills that fundamentally underlie the capacity of workers to absorb retraining and re-education.

RECOMMENDATIONS FOR FUTURE RESEARCH

Several broad areas of research are suggested by this review. One area would focus more intensively on the claim that changes in organizational structure are systematically increasing the economic returns to certain "new" sets of basic skills, such as interpersonal relations, while decreasing the returns to others. This research would address both components of this claim. Specifically, a series of case studies of British Columbia-based companies of various sizes might be undertaken to establish the

organizational changes that have taken place in the recent past along with the reasons for any observed changes. The null hypothesis here is that international competition is creating pressure on firms to "flatten out" their organizational hierarchy thereby placing more administrative and decision-making responsibility on workers. A related hypothesis is that firms are increasingly moving away from individual task specialization to team-based production accentuating the need for "team-based" skills.

While a substantial volume of research has focused on the impact of technological change on skill demand, there has been less work on the impact of organizational change, although the amount of work has been significant; however, much of it is anecdotal and tends to focus on examples that are likely to support the premise that important changes are taking place in organizational structures with attendant consequences for skill demands. We therefore propose research be undertaken whereby a randomly selected sample of British Columbia companies representative of the province's industrial structure form the basis for a series of case studies where the focus of the case studies is twofold: (i) what changes in organizational structure have and are taking place and what are the reasons for such changes? (ii) what effect are such changes having on the skills that employers require of workers and managers in different parts of the organization and how do the PLFE backgrounds of those workers and managers affect how easy or difficult it is to impart these skills through on or off-the-job training and education.? Both managers and non-managerial employees would be interviewed as part of the ongoing research.

A complementary research effort might focus on the relationship between PLFE backgrounds of workers and managers and the relative speed with which organizational and other innovations are adopted by organizations. There is again a large literature on the determinants of technological diffusion at the organizational

level; however, PLFE characteristics of employees are rarely specified in any detail as "independent" variables in these models. An important underlying rationale for changing the quantity or composition of basic skills curricula is that it will better enable Canadian organizations to respond to changes in the economic environment including technological changes. This study would attempt to quantify whether the educational backgrounds of employees are related to the behaviour of organizations with respect to adopting innovations that are important conditioners of competitive success.

There are several components of any such study. One is to identify a set of innovations. Without being specific, we suggest that the set include both "organizational" changes, e.g. just-in-time production techniques, as well as "physical", e.g. numerically controlled machine tools. As well, a set of potential adopters of these innovations would be identified across a number of industries. These firms would be interviewed or surveyed with the goal of developing a data base for each firm containing information on their adoption behaviour, e.g. when did they adopt an innovation and how extensively has it been adopted, as well as information on potential determinants of adoption including the educational characteristics of employees. The latter would include both the quantity and the nature of PLFE activities. These data would form the basis for statistical analysis aimed at identifying the role of PLFE activities as a determinant of innovation adoption behaviour.

Since the two studies described are complementary and rely heavily upon field survey techniques, they might be undertaken jointly, especially since there is a substantial overlap in the nature of the information required.

REFERENCES

Colin Bell and Cathy Howieson, "The View From the Hutch: Educational Guinea Pigs Speak About TVEI", in David Raffe, ed., Education and The Youth Labour Market: Schooling and Scheming, London: The Falmer Press, 1988, pp.222-242.

John Bruk, Keynote Address to the 19th Annual Economic Outlook Conference "Challenge of Today and Tomorrow" on Global Economic Challenges Ahead, Vancouver: November 13, 1990.

Ronald Cervero and Thomas Kirkpatrick, "The Enduring Effect of Family Role and Schooling on Participation in Adult Education", American Journal of Education, November 1990, pp.77-94.

Frank T. Denton, Peter C. Pineo and Byron G. Spencer, "The Constituencies of Adult Education Programs: Similarities and Differences Among Age Groups and Other Components of the Population", Journal of Education, Vol. 15, No. 1, 1990, pp.72- 89.

Don Dippo, "Occupational Analysis and Work Education", The Journal of Economic Thought, Vol. 22, October 1988, pp.87-97.

Stephen Easton, Education in Canada, Vancouver: The Fraser Institute, 1988.

Employment and Immigration Canada, Success in the Works: A Profile of Canada's Emerging Workforce, Ottawa: mimeo, April 1989.

Elizabeth M. Fowler, "An Emphasis On Training For the 1990's" in The New York Times, December 25, 1990, p.25.

Steven Globerman, "Formal Education and the Adaptability of Workers and Managers to Technological Change" in W. Craig Riddell, ed., Adapting to Change: Labour Market Adjustment in Canada, Ottawa: Minister of Supply and Servcies Canada, 1986, pp.41-69.

Pamela Grant, Youth Employment and Technological Change, Avebury: Aldershot, 1987.

Ontario Premier's Council, Report on Education, Draft 1, Toronto: mimeo, 1989.

Oswald Hall and Richard Carlton, Basic Skills at School and Work, Toronto: Ontario Economic Council, 1977.

Ron Johnson, "School To Work In Western Europe" in John Twining,ed., Vocational Education London: Kogan Page 1981.

Robert Lerman and Hillary Pouncy, "The Compelling Case for Youth Apprenticeship", The Public Interest, Fall 1990, pp.62-77.

Henry Levin and Russell Rumberger, "Education, Work and Employment in Developed Countries: Situation and Future Challenges", Prospects, Vol. XIX, Number 2, 1989, pp.205-224.

Sar Levitan and Frank Gallo, A Second Chance: Training For Jobs, Kalamazoo: W.E. Upjohn Institute, 1988.

Huey Long, New Perspectives on the Education of Adults in the United States, London and Sydney: Croom-Helm, 1987.

Ian Morrison and Kjell Rubenson, "Adult Training in an Information Economy", Learning, Vol.V, Number 2, 1989, pp.4-9.

Ontario Council of Regents, Vision 2000, Toronto, September 1989.
Province of British Columbia, Ministry of Education, Highlights Year 2000: A Framework For Learning, mimeo, 1990.

Premier's Council, People and Skills In The New Global Economy, Toronto: Queen's Printer for Ontario, 1990.

David Raffe, "The Story So Far: Research on Education, Training and the Labour Market From the Scottish Surveys" in David Raffe, ed., Education and the Youth Labour Market: Schooling and Scheming, London: The Falmer Press, 1988, pp.40-65.

David Raffe and Gill Courtney, "16-18 on Both Sides of the Border" in David Raffe, ed., op. cit., pp.12-39.

Report of the Provincial Literacy Advisory Committee To The Minister of Advanced Education, Training and Technology, Opening The Doors To Lifelong Learning: Empowering Undereducated Adults, Toronto: mimeo, 1989.

Brendan Ryan, "Schooling For Technological Change - Two Nations Once Again", Interchange, Vol. 20, Number 3, Fall 1989, pp.17-34.

Kenneth Spenner, "Technological Change, Skill Requirement and Education: The Case for Uncertainty" in Richard M. Cyert and David C. Mowery, The Impact of Technological Change on Employment and Economic Growth, Ballinger Publishing Company, 1988, pp.131- 184.

J.B.G. Tilak, "Economics of Vocationalization: A Review of the Evidence", New Delhi: National Institute of Educational Planning and Administration, mimeo, 1990.

Nils Tomes, "Changing Certification: Vocationalism and the School Curriculum" in David Raffe, ed., op. cit., pp.196-221.
Ralph Tyler, Basic Principles of Curriculum and Instruction, Chicago: The University of Chicago Press, 1949.

Curtis Ulmer and Huey B. Long, "New Perspectives On Literacy Education in the United States" in Huey Long, New Perspectives On The Adults in The United States, London and Sydney: Croom-Helm, 1987, pp.107-125.

David Vice, "Business and Education in Canada: The Critical Connection", Business In The Contemporary World, Autumn 1990, pp.52-53.

Klaus Weiermair, Apprenticeship Training in Canada: A Theoretical and Empirical Analysis, Ottawa: Economic Council of Canada, Discussion Paper 250, 1984.

Edwin G. West, Higher Education in Canada, Vancouver: The Fraser Institute, 1988.